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Keywords

Budget, Deficit, Financing, its, Macroeconomic, Impact, Case, Lebanon

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Budget Deficit Financing and its Macroeconomic Impact: the Case of Lebanon

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Budget Deficit Financing and its Macroeconomic Impact: the Case of Lebanon

Abstract

The objective of this paper is to explore, from a primarily theoretical perspective, the macroeconomic implications arising from the Lebanese government's approach to dealing with its crippling budget deficits. The aim is to develop a macro model that distinguishes between different types of government expenditure (capital or current), emphasising the importance of budget deficit financing (e.g. by monetary accommodation or bond financing). This macroeconomic model is utilised to analyse the effects of exogenous shocks arising from increased government expenditures (capital expenditure or consumption expenditure) upon key macroeconomic variables. The current government's overall economic policy approach, as well as the impact of each individual component of the policy strategy, in response to the Lebanese fiscal crisis is also analysed using this macroeconomic framework. Due to the complexity of the model it is not possible, however, to derive analytically unambiguous results, consequently a calibrated solution for the model is conducted, with the aim of identifying how best to improve the country's macroeconomic performance.

The study empirically estimates the behavioural equations of the macroeconomic model using efficient estimation techniques (FIML, ECM) and appropriate data definitions for Lebanon. These estimates provide a range of possible parameters values that are used to conduct a numerical simulation and policy analysis. One of the major findings from the simulation results is that implementing a policy of expansionary government capital expenditure produces larger favourable impacts (in comparison with the policy of expansion in government consumption expenditure) upon Lebanese economic development, in terms of private sector investment and the supply side of the economy (crowding in effects), during the adjustment process towards long run steady state. The simulation results show that monetary deficit financing is inflationary and contributes to interest rate sensitivity. Bond financing is non inflationary and contributes little to interest rate sensitivity. Another important conclusion is that reducing government expenditure, in order to reduce the budget deficit, may not be an advisable strategy, and especially a policy of reducing government capital expenditure.

Keywords: Macro model, budget deficit, financing, simulation analysis, Lebanon

JEL Classification: E62

1. Introduction

The budget deficit issue and its impact upon economic performance has attracted considerable attention over the past few decades. This attention is reflected in substantial debate among academics and policy makers alike. The budget deficit has become a major problem facing the Lebanese economy and currently attracts much attention from politicians, international organizations, such as the IMF, and during election campaigns.

This attention towards the budget deficit issue stems mainly from the fact that budget deficits in Lebanon have become so large and especially during the last few decades. Most of the deficit occurred during the period of the Civil War (1975-1990), and the post-war reconstruction period (1990-2000). The budget deficit, as a percent of GDP, increased from only 3% in 1975 to 32.3% in 1989. Then, one of the highest amongst the countries of the Middle East. As a result, Lebanese public debt started to increase after 1975. By the end of 1990 gross public debt represented 99.8% of GDP. Of this, 80.6% was due to domestic public debt and the rest, 19.2%, was external public debt. The second phase of the evolution of the deficit and public debt in Lebanon was during 1993-2000. As a result of rebuilding the country's infrastructure (the government's crucial contribution to the reconstruction effort), the acceleration in the growth of government capital expenditure, together with large and expanding current expenditure and the slow recovery of the revenue-generation capacity, led to sizable fiscal imbalances. Consequently, government budget deficits increased from 9.2% of GDP in 1993 to 20.2% and 23.7% in 1997 and 2000 respectively.

Hence, the main purpose of this study is to examine the macroeconomic implications arising from the Lebanese government's approach to dealing with the budget deficit, which has become one of the highest amongst the Middle East countries.

This paper develops a dynamic macroeconomic model for Lebanon including the budget deficit and its funding, as well as the composition of government expenditures (capital or current). The other aim of this paper is the application of a simulation analysis to the Lebanese economy. This involves the conduct of a numerical simulation analysis of the macroeconomic model developed, in order to analyse the effects of exogenous shocks arising from increased government expenditures (capital expenditure or consumption expenditure) upon key macroeconomic variables. The current government's policy approach in response to the Lebanese fiscal crisis is also analysed as well through the use of this macroeconomic model. The objective being to identify policies that reduce the macroeconomic consequences of these shocks and hence improve the macroeconomic performance in Lebanon.

The paper is divided into five main sections. Section 2 examines budget deficits and public debt in Lebanon. Section 3 reviews the literature in regard to budget deficits and public expenditures. Section 4 specifies the conceptual framework. Section 5 specifies the estimation results. Simulation and key policy implications are discussed in section 6. Section 7 concludes by listing the main findings from our simulation results in the context of the Lebanese fiscal deficit.

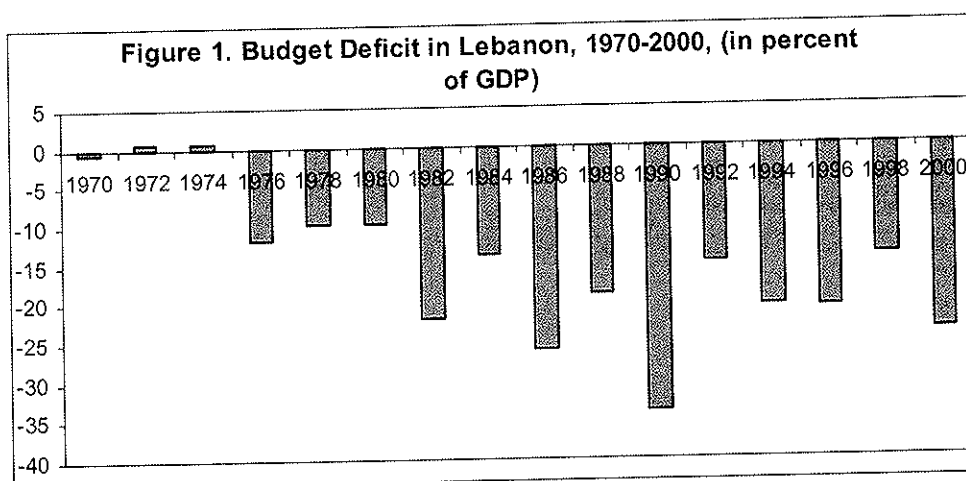
2. Budget Deficits and Public Debt in Lebanon

Prior to 1975 the government budget was always balanced and the government had never resorted to borrowing. Hence, borrowing and deficits are a recent phenomena in Lebanon, and it is of interest to note the creation and evolution of deficit financing. As is the case in any country, the government can borrow from the general public, the

central bank, and the commercial banks. It should be noted here that the period of 1975-1990 was the most difficult of the Lebanese crisis, because of the Civil War, political crisis, and the Israeli invasion of Beirut in 1982.

As can be seen from Figure 1 the increase in public deficits in Lebanon occurred after 1974, but the largest increases occurred after 1980 and peaked during the 1980s and 1990s. This was a period (1975-1990) of deepening crisis for the Lebanese economy, as evidenced by the marked deceleration in economic growth and private investment activity. The budget deficit, as a percent of GDP, increased from only 3% in 1975 to 32.3% in 1989, and was one of the highest amongst the Middle East countries. Increased government expenditure and declining government revenues were both responsible for the steep increase in the public sector deficits. Total government expenditure as a percentage of GDP increased from 15.4% in 1972 to 39.4% in 1990. The dramatic increase in total government expenditure was mainly made up of current expenditure, the generous wages and salaries paid to government employees, and the interest payments on the public debt.

Government revenues, on the other hand, remained very low as a proportion of GDP during the period of 1975-1990 (around 6%), due to the slowdown of economic activity, the inability of the government to collect revenues (Lebanon's Civil War), most of the government's revenues were in the form of indirect taxes, and custom and trade taxes became difficult with the loss of control over legal ports of entry and a consequent surge in illegal imports. In addition, Lebanon's budgetary capital expenditure witnessed a decline as well from 6% of GDP in 1980 to 1.7% in 1990, and contributed to the deterioration in Lebanon's public capital stock.

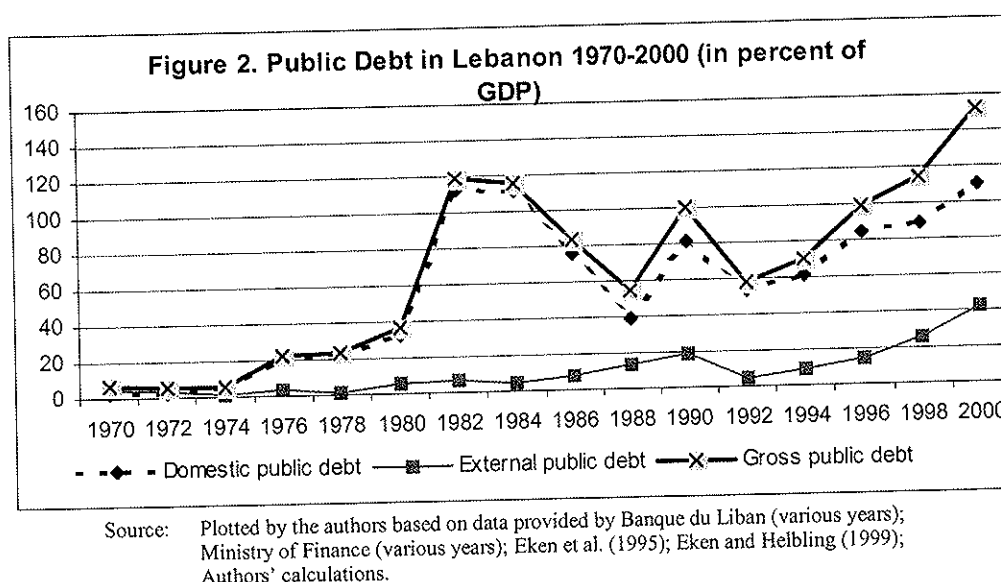


Source: Plotted by the authors based on data provided by Banque du Liban (various years); Ministry of Finance (various years); Eken et al. (1995); Eken and Helbling (1999); Authors' calculations.

During 1970-1975 the average annual growth of nominal gross public debt registered only 3.5%, and the nominal gross public debt as a percent of GDP averaged 5.4%. Therefore, in the pre-war period public debt was not a major concern for Lebanon. As a result of large budget deficits during 1975-1990 Lebanese public debt started to increase after 1975, but the largest increases occurred after 1980 and peaked during the 1980s and 1990s (Figure 2).

Over the post-war period (1991-2000), and as a result of rebuilding the infrastructure (the government's crucial contribution to the reconstruction effort), the acceleration in the growth of government capital expenditure, together with large and expanding current expenditure and the slow recovery of the revenue-generation

capacity, led to sizable fiscal imbalances. Consequently, government budget deficits increased from 9.2% of GDP in 1993 to 20.6% and 23.7% in 1996 and 2000 respectively. This huge increase in the budget deficit led to a sustained growth in government debt during the period 1993-2000 (Figure 2). In addition, domestic public debt as a percent of GDP increased from 44.2% in 1993 to 86.5% and 109.5% in 1997 and 2000 respectively. The external public debt as a percent of GDP increased from only 4.3% to 16.4% and 42.3% in 1997 and 2000. Therefore, the majority of the public debt in Lebanon is in the form of domestic public debt. However, money creation remained the primary method of budget financing supplemented by the sale of treasury bills to the private sector. It has been argued that the main effect of the huge budget deficit, and the way it was financed, led to a permanent deficit in the budget, higher interest rates, increases in the money supply, rising inflation, a depreciation of the Lebanese pound, stagnation and a slowing of economic growth.



3. Empirical Literature on the Relationship Between Budget Deficits and Public Expenditure: an overview

There are two major views on the effects of increased government expenditure on investment. The traditional one argues that government expenditure crowds out private investment, while the non-traditional view sees government expenditure stimulating investment. The crowding in of investment occurs when the economy's resources are un-and underemployed. Much empirical work exists that examines the effect of government expenditure on economic growth. Guess and Koford (1984) used the Granger causality test to find the causal relationship between budget deficits and inflation, GNP, and private investment using annual data for seventeen OECD countries for the period 1949 to 1981. They concluded that budget deficits do not cause changes in these variables. Furthermore, there are other studies that examine the relationship between government spending and economic growth using cross-country data in attempts to explain the observed differences in growth rates across countries. For example, Landau (1983), in a cross-sectional study of over 100 countries reported evidence of a negative relationship between the growth rate of real per capita GDP and the share of government expenditure in GDP.

Using annual data for the US over the period 1953-1986, Aschauer (1989) empirically examined the effect of public expenditure on private investment and the rate of return to private capital. He argues that an increase in public investment may be expected to reduce private investment nearly one-to-one as the private sector utilises the public capital for its required purposes rather than expand private capacity. At a deeper level, a distinctive feature of public infrastructure capital is that it complements private capital in the production and distribution of private goods and services. Hence, public investment might be thought to raise private investment as the former raises the profitability of private capital stock. The empirical results indicate "that while both channels appear to be operating, the latter comes to dominate, so the net effect of a rise in public investment had a positive effect on private investment" (Aschauer, 1989, p. 186). This means that government investment had a positive effect on private investment and caused "crowding-in" rather than "crowding-out".

Miller and Russek (1997) consider a sample of developed and developing countries from 1975 to 1984. They find that both the method of financing and the component of government expenditure can have different effects. Debt-financed increases in defence, health, and social security and welfare expenditures negatively affect the growth of real per capita GDP in developing countries, while debt-financed increases in education expenditure positively affected growth in developed countries. Miller and Russek (1997) differ from prior studies in that they separate the effects of government expenditure based on the method of financing - tax or debt financing.

Ghali and Al-shamsi (1997) utilised cointegration and Granger-causality to investigate the effects of fiscal policy on economic growth for the small oil producing economy of the United Arab Emirates over the period 1973:1-1995:4. They decomposed public spending into consumption and investment expenditures and show how multivariate cointegration techniques can be used to test for the long-run relationships and the intertemporal causal effects between government spending and economic growth. This study provides evidence that government investment has a positive effect on economic growth, whereas the effect of government consumption is insignificant (Ghali and Al-Shamsi, 1997, pp. 530-31).

Ahmed and Miller (2000) examined the effects of disaggregated government expenditure on investment using OLS, fixed-effect, and random-effect methods. This study introduced a government budget constraint; it also distinguished between tax - and debt-financed expenditure. They used pooled time-series, cross-section data (39 countries, 23 developing countries and 16 developed ones) over the period 1975-1984. They conclude that expenditure on transportation and communications, crowds in investment for developing countries only; tax-financed government expenditure, in general, crowds out investment more frequently than debt-financed government expenditure; and expenditure on social security and welfare crowds out investment for both tax and debt-financed increases in both developing and developed countries.

The key outcomes from the studies presented in this section show that both the method of financing and the components of government expenditure could have different effects. Therefore, it is crucial to distinguish between current and capital expenditure when evaluating the impact of fiscal policy on private investment and output growth. Thus, overall results from the empirical literature with respect to the impact of public investment on private investment and growth are ambiguous, but the bulk of the empirical literature finds a significantly negative effect of public consumption expenditure on growth while the effects of public investment expenditure are found to be positive although less robust.

Finally, in the context of this study no empirical studies have been conducted for Lebanon regarding the relationship between the budget deficit and macroeconomic variables. The only studies conducted in this area are theoretical works.

Bolbol (1999a) develops a theoretical framework¹ to explain the phenomena of seigniorage, dollarisation and public debt; and applies this to the Lebanese macroeconomic situation over the period of 1982-1997. This study concluded that budget deficits were only one of the reasons behind the inflation and exchange rate depreciations during the Civil War.

Bolbol (1999b) analysed the Lebanese deficits and debts over the post-war period. He developed certain equations for the rate of growth of net debt-to-GDP and net debt interest payments-to-GDP ratios, and studied their determinants. He concluded that the budget deficits are a symptom of a weak economy (Bolbol, 1999b, p. 442). Chami (1992) theoretically analysed the macroeconomic performance in Lebanon during 1975-1990 (Civil War). He argues that "the central government has become completely paralysed and unable to collect tax revenue but continues to spend in order to maintain essential services, pay wages and salaries and subsidize some basic imported goods". As a result, this led to substantial budget deficits financed by the central bank and commercial banks. This study concluded that the budget deficit led to a massive increase in the money supply, high inflation rates and a severe depreciation of the Lebanese currency. Only empirical testing of the theoretical models would give credence to such conclusions.

4. Theoretical Framework - Macroeconomic Model

The conceptual model to be developed for Lebanon is a long-run macroeconomic model the foundations of which are based on the contributions of Dornbusch (DB)² (1976) and the Portfolio Balance Model (PBM)³ (Branson, 1977), and also of Harvie and Kearney (HK, 1996). It is worth mentioning as well that the DB and PBM models have a number of deficiencies, especially the neglect of the supply side of the economy; they also do not focus on the way of funding the budget deficit and the composition of government expenditure. However, many amendments need to be made to these existing models in order to make them applicable to the case of Lebanon, especially to analyse the impact of the composition of budget funding (e.g. monetary accommodation or bond financing⁴) and the composition of government expenditure shocks, capital and current, on macroeconomic variables (such as output, prices, interest rates, among others).

The model developed focuses upon the main aspects of the current Lebanese crisis, which is the public sector deficit. First, the model developed distinguishes between two types of government expenditure, capital expenditure and current expenditure. Second, the model developed incorporates budget deficit funding via bond financing (pure fiscal policy), via money accommodation (pure monetary policy) or a mixture of the two. Third, it incorporates exogenous shocks arising from an increase in the budget deficit such as that arising from an increase in government expenditure and the impact of this on macroeconomic variables.

¹ For a detailed discussion about the theoretical frameworks developed in this study, see Bolbol (1999).

² For a detailed discussion about this model see Dornbusch (1976); Macdonald (1988); Copeland (1994).

³ For a detailed discussion about this model see Branson (1977; 1984); Pentecost (1993).

⁴ This study focuses only upon money and bond financing of budget deficits. Tax financing is not considered, and is the subject of further study.

4.1 *Extension to the Existing Literature*

4.1.1 *The Supply Side of the Economy*

Both the DB and PBM models focus on the demand side of the economy and upon the role of financial markets in transmitting the effects of changes in policies. Therefore, these general models neglect the supply side and the determination of the supply and demand for labour and therefore aggregate supply. This is remedied in the HK model, because they incorporate capital stock accumulation and the wage-price nexus and aggregate supply. However, the PBM model does not mention the role of physical capital stock accumulation during the adjustment process. The main contribution of the HK model is that they permit endogenous capital stock accumulation in influencing output supply. The HK model also gives particular attention to the role of capital stock accumulation in expanding total output. Furthermore, the model to be developed incorporates exogenous shocks arising from an increase in the budget deficit such as from an increase in government expenditure and the impact of this on macroeconomic variables.

4.1.2 *Composition of Public Expenditure*

As discussed in the literature section, one of the important outcomes from the empirical studies examining the impact of public expenditure on private investment and economic growth is the need to distinguish between current and capital expenditure when evaluating the impact of fiscal policy on private investment and economic growth. Each of these categories of expenditure could have a different impact on private investment and economic growth. Therefore, the model developed takes into account these two categories of public expenditure, by separating them into current expenditure (government consumption such as on wages and salaries, interest payments, subsidies, among others) and capital expenditure (such as infrastructure, among others). Hence, this study examines the impact of both current expenditure as well as capital expenditure on macroeconomic variables (output, prices, interest rates, exchange rate, among others) with the aim of drawing substantive policy implications.

4.1.3 *Fiscal Policy and Alternative Funding Options for the Budget Deficit*

As noted previously, one of the criticisms of the PBM is that it does not give much attention to the composition of government expenditure and the impact of this on macroeconomic variables. This model also does not focus on the effect of fiscal deficits and their funding on output and other macroeconomic variables. It only focuses on the impact of the fiscal deficit and its funding on the interest rate and exchange rate.

However, the model to be developed will incorporate three alternative funding options, pure fiscal policy (bond financing), pure monetary policy (money accommodation), and a mixture of these two policies with, with the aim of studying the impact of each of these funding options on output, prices, interest rates, and other macroeconomic variables. The model developed is used to conduct a simulation analysis to compare the macroeconomic consequences of each of these funding options on macroeconomic variables, with the aim of identifying which one of them produces more desirable outcomes for output and for the Lebanese economy as a whole.

4.2 *The Macroeconomic Model in the Case of Lebanon*

The model is based upon a number of important assumptions, including the following. First, it assumes that the Lebanese economy operates under a flexible exchange rate and perfect capital mobility. Lebanon is a small open economy that operates with a flexible exchange rate and no capital controls. Under a flexible rate regime the nominal exchange rate adjusts so achieve balance of payments equilibrium and capital inflows or outflows will have no effect upon foreign exchange reserves and hence the domestic money supply. Therefore, the money supply is exogenous, and the nominal exchange rate is endogenous. An appreciation/depreciation of the exchange rate adjusts the balance of payments to equilibrium. Furthermore, under perfect capital mobility two assumptions need to be addressed. First, freedom of capital movement implies an absence of impediments to capital flows in the form of capital controls, taxes and so on. Second, there is perfect substitutability of assets denominated in domestic currency and foreign currency. Therefore, the uncovered interest parity condition holds ($\dot{e} = r - r^*$). This is the case where capital is freely mobile and assets are assumed to be perfect substitutes.

Second, the model is dynamic and concentrates upon long run adjustment; economic agents possess rational expectations and possess complete information (as with the HK model). This is equivalent to the case of perfect foresight. Such an assumption implies that economic agents are rational and do not make consistent forecasting errors, and financial markets are efficient. Alternative assumptions can be made regarding the way in which economic agents form their expectations, but these would imply irrationality and consistent errors in economic forecasts (such as with the assumptions of adaptive expectations). Third, financial markets are assumed to be in continual equilibrium. On the other hand non-financial markets do not clear continuously, because they are subject to sticky price and quantity adjustment. Globalisation of financial markets, the sheer volume of international capital flows, and advances in information and communications technology have resulted in very rapid adjustments of financial variables such as exchange rates and domestic interest rates. Financial market disequilibrium produces arbitrage opportunities that are quickly, in fact instantaneously, eliminated. In non-financial markets the existence of wage and price contracts and time involved in adjusting output quantities indicates that, in such markets, there is stickiness of adjustment of prices and quantities. Consequently, such markets can be in disequilibrium. For a small economy such as Lebanon, such conditions are likely to hold.

Fourth, the model also emphasises the supply side of the economy, wealth effects, capital stock accumulation, budget deficits and their funding. In addition, there are assumed to be four financial assets, domestic money, domestic bonds, foreign bonds, and equities, which determine the q ratio. Assets denominated in either domestic currency and foreign exchange are assumed to be perfect substitutes, with arbitrage between them resulting instantaneously in the same expected rate of return. In the case of Lebanon with open financial markets and important role of government through its expenditure and financing of its budget deficits, financial investors can choose how best to hold their wealth – bonds issued by government, domestic money, foreign bonds (assets) and domestic stocks and shares. Portfolio adjustment by investors will trigger developments in financial variables (for example stock prices) that will impact upon non-financial markets, such as business investment decisions that will also affect the economy's supply capacity. Government capital expenditure on infrastructure will also

affect the economy's productive capacity. For Lebanon these developments are important, and need to be explicitly incorporated in any macro model for this economy.

The equations of the model are now presented. The model is divided into four sub headings: product market, assets market, wage-price nexus, and definitions. As shown in Table 1, all equations in the model, except the domestic nominal interest rate and the world interest rate, are reported in log-linear form.

Equilibrium in the model depends upon simultaneous equilibrium in the product market, assets market and external balance. Firstly, equilibrium in the product market will be outlined.

The product market consists of nine equations, which are presented by equations (1)-(9). The demand for real output (y^d) is given by equation (1). So the demand for real output in this study comprises private consumption, private investment, government expenditure (which is given by equation (6) and is comprised of a weighted average of both government consumption and government capital spending), and the trade balance consisting of exports less imports. Equation (2) describes private consumption, which depends positively on the level of real income (aggregate supply) and real private sector wealth. Equation (3) describes private investment, which equals the change in the stock of private capital, and depends on Tobin's q . Equation (4) describes government consumption spending as being an exogenously determined variable, whilst government investment spending (equation (5)) arises from a gradual adjustment of the actual public capital stock to its policy-determined level. Identification of the role and importance of government expenditure, in the case of the Lebanese economy, is an important objective of this study.

Equation (6), as mentioned before, describes total government expenditure, which depends positively on two components of expenditures: government consumption expenditure (c^g) (exogenous) and government capital spending; and depends negatively on the supply of output. There is also another part of government consumption expenditure (endogenous), which depends on the supply of output (y^s). This arises due to welfare/unemployment expenditure. When output is high, unemployment is low and hence welfare expenditure in this area is low and vice versa.

Equation (7) describes the budget deficit, which is government expenditure less tax revenues. The budget deficit as shown in this equation can be financed in three ways, through an expansion in the money supply and/or domestic bonds, or a combination of the two. Equation (8) is tax revenue, which depends positively on the supply of output. Equation (9) describes the trade balance, which depends positively upon the real exchange rate (the nominal exchange rate deflated by the domestic price ($e-p$)), negatively on aggregate demand for domestic real output, and positively on world real income.

Asset market equilibrium is given by equations (10)-(14). Four financial assets should be addressed here, domestic money, domestic bonds, foreign bonds, and equities which determines the q ratio. Assets denominated in domestic currency and foreign exchange are assumed to be perfect substitutes, with arbitrage between them resulting instantaneously in the same expected rate. Equation (10) identifies the demand for real money balances, which depends positively on the level of aggregate demand and domestic real wealth, and negatively on the domestic interest rate.

Table 1 The Macroeconomic Model

Product Market

$$y^d = \alpha_1 c^p + \alpha_2 i^p + \alpha_3 g + \alpha_4 T \quad (1)$$

$$c^p = c_1 y^s + c_2 w^p \quad (2)$$

$$i^p = \dot{k}^p = \eta q \quad (3)$$

$$c^g = \bar{c}^g \quad (4)$$

$$i^g = \dot{k}^g = \psi(k^{g*} - k^g) \quad (5)$$

$$g = \beta_1 c^g - \beta_2 y^s + \beta_3 i^g \quad (6)$$

$$bd = g - t = a_1(\dot{m} - \dot{p}) + a_2(\dot{b} - \dot{p}) \quad (7)$$

$$t = \tau y^s \quad (8)$$

$$T = \mu_1(e - p) - \mu_2 y^d + \mu_3 y^* \quad (9)$$

Assets Market

$$m = p + \sigma_1 y^d - \sigma_2 r \quad (10)$$

$$R = \gamma_1 y^s - \gamma_2 k^p + \gamma_3 k^g \quad (11)$$

$$\dot{q} = \delta_3^{-1} [q - \delta_1 R + \delta_2 (r - \pi)] \quad (12)$$

$$w^p = \Omega_1(f + e - p) + \Omega_2(k^p + q) + \Omega_3(m - p) + \Omega_4(b - p) \quad (13)$$

$$\dot{f} = \varepsilon_1 T + \varepsilon_2 r^* f - (1 - \varepsilon_2)(e - p) \quad (14)$$

Wage/Price Nexus

$$p = \delta w + (1 - \delta)e \quad (15)$$

$$\dot{w} = \phi_1(y^d - y^s) + \phi_2 \pi \quad (16)$$

$$y^s = \lambda_1 k^p + \lambda_2 k^g - \lambda_3(w - p) \quad (17)$$

Definitions etc

$$c = e - w \quad (18)$$

$$l = m - w \quad (19)$$

$$\dot{m} = \pi \quad (20)$$

$$\dot{e} = r - r^* \quad (21)$$

$$B = b - w \quad (22)$$

A dot (.) above a variable signifies its rate of change.

Table 2 Explanation of Symbols Used in the Model

Endogenous Variables

y^d	Aggregate demand for real output
c^p	Private consumption
i^p	Private investment
g	Total government expenditure
T	Trade balance
t	Total tax revenues
r	Domestic nominal interest rate
R	Real profit
f	Foreign asset stocks
e	Nominal exchange rate
b	Nominal Domestic bonds (this variable is endogenous with the condition that $\dot{b} = 0$ in the long run)
p	Domestic price level
w	Domestic nominal wage
y^s	Aggregate supply of output
w^p	Real private sector wealth
k^p	Private capital stock
k^g	Actual public capital stock
q	Tobin's q
c	Real exchange rate
l	Real money balances
π	Inflationary expectations
B	Real domestic bonds

Exogenous variables

c^g	Government consumption
k^{g*}	Desired public capital stock
y^*	World real income
r^*	World nominal interest rate (also the world real interest rate since world prices (and hence inflation) is assumed exogenous (constant))
m	Nominal money supply

Equation (11) represents the real return on private capital, which depends positively on the level of real income (measured by output supply), negatively on the stock of private capital due to diminishing marginal returns, and positively on the stock of public capital. The latter holds because public capital and private capital are assumed here to be complementary in nature. The productivity of private capital rises as the government provides more public investment such as in the form of infrastructure (Aschauer, 1989).

Equation (12) identifies the change in Tobin's q ratio. It comes from the arbitrage condition equating the returns on domestic and foreign bonds and equities. Equation

(13) describes private sector wealth, which depends positively on the real domestic currency value of domestically held foreign assets (f), on the value of the private capital stock ($k^p + q$), on real money balances ($m - p$), and on holdings of real bonds ($b - p$). Equation (14) defines the current account of the balance of payments, which is equivalent to the change in domestic holdings of foreign assets, which depends positively on the trade balance, foreign interest income ($r * f$), and negatively on the real exchange rate. In long run steady state the current account balance must be zero, otherwise further wealth effects will increase which in turn implies further macroeconomic adjustment.

The wage-price nexus and aggregate supply of output is given by equations (15)-(17). Equation (15) describes the domestic price level, which is a weighted average of domestic nominal wages and the world price of the imported good. Equation (16) describes nominal wage adjustment, which adjusts in line with a simple inflation expectations augmented Phillips curve. Equation (17) identifies aggregate supply, derived from a simple production function relationship, and depends positively on the private capital stock, public capital stock, and negatively on the real wage rate.

Finally, equations (18)-(22) define the following. Equations (18)-(19), define two variables used in this model, the real exchange rate and real money balances respectively. Equation (20) shows that inflationary expectations depend upon the monetary growth rate. Equation (21) identifies the characteristic of a flexible exchange rate and perfect capital mobility. With a flexible nominal exchange rate the money stock is exogenously determined in the model. With perfect capital mobility the risk premium does not exist. Assets are assumed to be perfect substitutes, and arbitrage between them implies the same expected rate of return. Equation (22) defines real bonds. These definitions are useful for the solution of the model.

5. Model Estimation

The data utilised for the estimation are yearly data from 1970-2000. However, it is important before performing any empirical estimation for the macroeconomic model to analyse the time series data in this study. The analysis of the data depended on finding out whether the series are stationary or non-stationary. Stationary refers to the condition in which the mean and variance of the series stay about the same over the length of the series. However, firstly, to test if a time series is non-stationary this study used the Augmented Dickey-Fuller (ADF) test⁵, which examines the hypothesis that the variable in question has a unit root. If the series is found to have a unit root, differencing the data is appropriate before performing the regression analysis, to avoid the problem of spurious regression arising from non-stationary time series.

Secondly, this study involves testing for cointegration using Johansen's full information maximum likelihood (FIML) approach (Johansen, 1988; 1991; 1995) to detect for the existence of a long run relationships between the variables included in this study. To investigate the short-run dynamics of the system with the information of the cointegration relationship, an error-correction model (ECM) (Engle and Granger (1987)) is estimated (if there is a long-run cointegrating relationship). However, this

⁵ The Dickey-Fuller test comes in a variety of forms, including an augmented test to use in cases of a serially correlated error term, see Dickey and Fuller (1979) for more detailed discussion.

study used annual data for the sample period 1970-2000⁶. Different sources for data were researched (Lebanese government, private sector, and international organisation) to find out the nature of the available data. It was found that some variables are available as a complete series while other variables are not available in official statistics and they are not a complete series. There are some gaps in some years because of the Civil War period during 1975-1990, which made the task of issuing Lebanese data by the government very difficult during that time.

All the annual data used in this study cover the sample period of 1970-2000, and have been taken from many sources such as the IMF, the International Financial Statistics Yearbook (IFS); World Bank (WB), World Tables, various issues; United Nations, National Account Statistic (NAS), various issues; Eken et al., IMF, Occasional Papers (1995; 1999); Ministry of Finance, Lebanon, various years; Central Bank of Lebanon or Banque du Liban (BDL), Annual and quarterly reports, various issues; The Economist Intelligence Unit (EIU), Country Profile, (1998-2000); Banque Audi (BA), Economic Research Unit (2000).

5.1 Test for Stationarity – ADF Test

This section examines the time series data to find out whether the series are stationary or non-stationary by using the most popular test, which is the Augmented Dickey-Fuller (ADF) test. In order to ascertain the time-series properties of the data sample concerned the ADF test is undertaken. The ADF regression results are shown in Tables 3 and 4 respectively. It is worth noting here that the Schwarz Bayesian Criterion (SBC) (maximum SBC value) is used to select the optimum ADF lag⁷. These optimum lags are shown in parentheses beside each test statistic value (See Tables 3 and 4 at the end). Table 3 computes the ADF statistics for models with an intercept term but not a trend; Table 4 gives the ADF statistics for models with an intercept and a linear deterministic trend. However, these findings show that the only variables that are stationary are real private consumption (c^p), real government investment (i^g) and real private investment (i^p) when the trend is excluded from the ADF test (see Table 3). Real private investment appears to be non-stationary I(1) when the trend is included in the test. The variable is therefore non-stationary around the trend but stationary around the intercept. Furthermore, the test of the real private investment variable is biased towards I(1) (Perron, 1989) because this variable includes structural breaks which occur during the 1980s (Israeli invasion in 1982), hence real private investment (i^p) may be I(0).

The calculated test statistics unambiguously show that the following twelve variables: namely, real trade balance (T), real government consumption (c^g), rate of change of domestic nominal wage (\dot{w}), domestic real wage ($w-p$), inflationary expectations (π), rate of change of real net foreign assets (\dot{f}), domestic nominal interest rate (r), foreign interest rate (r^*), real money supply ($m-p$), real output demand (y^d), and foreign interest payments (r^*f) and the foreign income (y^*) are non-stationary I(1) whether a trend is included or not (see Tables 3 and 4 at the end). Hence these variables are most likely to be I(1).

⁶ This study has chosen annual figures because the data for the whole time series from 1970 to 2000 are only available in this form. This period includes the pre-civil war period (190-1974), the Civil War period (1975-1991), the civil peace and reconstruction period (1992-2000).

⁷ The maximum lag is set to be three because of the small sample constraining the degrees of freedom.

Furthermore, the ADF regression results indicate that the following four variables: namely, real private sector wealth (w^p), real public capital stock (k^g), real private capital stock (k^p), and real exchange rate ($e - p$) are non-stationary. However they may be either I(1) or I(2) because they are sensitive to the inclusion of the trend. When the trend is excluded from the ADF test these variables are non-stationary I(1), but when the trend is included in the test these variables become non-stationary I(2).

Furthermore, the ADF regression results show that the following five variables: namely nominal exchange rate (e), domestic price level (p), domestic nominal wage (w), real net foreign assets (f) and the foreign assets stock ($f + e - p$) are non-stationary I(2) whether a trend is included or not.

5.2 Estimation Results

Some of the behavioural equations of the model are estimated by applying the cointegration and error-correction techniques (results are not reported here). Preliminary data analysis was conducted using OLS estimation on the variables, which were made stationary by differencing according to the ADF test results. The results are not reported here due to space limitations and because the cointegration estimation, being FIML (full information maximum likelihood) is a preferred procedure. These techniques (cointegration and error-correction) permit for the possible determination of both long run and short run relationships among the variables involved. However, because of the limitation and unavailability of certain data this study estimates only the following ten behavioural equations of the model (1), (2), (6), (7), (9), (10), (13), (14), (15), (17). The estimation results for the ten equations are not presented in detail here, however a summary of these estimates (the long run and short run estimated from cointegration and the error correction model) is presented in Table 5. Each individual equation was evaluated using descriptive statistics such as t-values, F test, Durbin-Watson (DW) test, R^2 (coefficient of determination) and the standard error of the regression.

6. Simulation Results

The analysis of the steady state and dynamic properties of the model is calibrated through the use of the numerical values of the parameters of the model. The parameter values utilised are those identified in Table 6.

Three scenarios arising from exogenous shocks and their impact upon six macroeconomic variables are presented in this section.

The results of each shock upon the adjustment of key macroeconomic variables are presented in Figures 3 to 8. The horizontal axis contains the time period and the vertical axis indicates the percentage deviation of that variable from baseline, its initial value. Each diagram is divided into four adjustment periods. The impact period occurs immediately on the occurrence of the exogenous shocks. The short run period, which is assumed to occur over a period of two years⁸, the medium run period is assumed to occur from two to four years and the long run period is assumed to occur from four years onwards until steady state is achieved.

⁸ Assumed here to be equivalent to 8 time periods – each time period assumed to be a quarter of a year.

Table 5 Estimated Parameters for the Ten Behavioural Equations of the Model

Equation	Variables	LR estimated coefficients (a)	SR estimated coefficients (b)	Equation	Variables	LR estimated coefficients (a)	SR estimated coefficients (b)
(1)	c^p	1.0000	-0.9979***	(13)	$(f + e - p)$	0.6427***	-0.1695
	i^p	-0.0855	0.1690*		$(k^p + q)$	0.2549***	0.4108*
	g	1.2320	-2.8730		$(m - p)$	0.6741***	-1.0507**
	T	-0.1103	-0.3549***		$(b - p)$	-0.0565***	0.0100
(2)	y^s	0.4152***	-0.4933***	(14)	T	0.2119	-0.1521
	w^p	0.1739***	0.2848		$r * f$	0.0121***	-1.0651
(6)	c^g	0.0204			$(e - p)$	0.4216***	2.7270**
	y^s	-0.8370	-0.0038				
	i^g	0.6577***	0.8619				
(7)	$(\dot{m} - \dot{p})$	0.5364	-0.1859	(15)	w	0.3664	0.3414
	$(\dot{b} - \dot{p})$	1.2634	-0.0472		e	0.6141***	0.6698*
(9)	$(e - p)$	1.5233***	-0.6185	(17)	k^p	0.5478*	0.2744
	y^d	0.4385	-0.2225		k^g	0.2360	-0.5644
	Y^*	0.3445			$(W - P)$	-0.9298***	0.1675
(10)	y^d	0.2200	0.2803**				
	r	-0.2263	0.0084				

Note: (a) Estimated coefficients obtained from the FIML approach

(b) Estimated coefficients obtained from the ECM approach

* significant at the 10% level** significant at the 5% level.*** significant at the 1% level.

Table 6 Estimated and Imposed Parameters for the Simulations

Equation	Parameters	LR estimated coefficients (1)	SR estimated coefficients (2)	Confidence intervals		Chosen parameter from (1) or (2)	Chosen/imposed parameters	Sources for imposed parameters
(1)	α_1	1.0000	-0.9979			1		
	α_2	-0.0855	0.1690	-0.3632	0.1920	0.1		
	α_3	1.2320	-2.8730	-3.1249	5.3713	1		
	α_4	-0.1103	-0.3549	-0.5862	0.3655	0.1		
(2)	c_1	0.4152	-0.4933	0.1047	0.7257	0.4		
	c_2	0.1739	0.2848	0.0506	0.2972	0.2		
(3)	η						0.7	*
(5)	ψ						0.7	*
(6)	β_1	0.0204		-0.2640	0.3048	0.02		
	β_2	-0.8370	-0.0038	-3.8170	2.1429	0.8		
	β_3	0.6577	0.8619	-1.5274	2.8430	0.6		
(7)	a_1	0.5364	-0.1859	-0.9989	0.6270	0.2		
	a_2	1.2634	-0.0472	-0.6024	0.0823	0.1		
(8)	τ						0.8	@
(9)	μ_1	1.5233	-0.6185	0.7889	2.2576	0.6		
	μ_2	0.4385	-0.2225	-0.1122	0.9893	0.4		
	μ_3	0.3445				0.4		
(10)	σ_1	0.2200	0.2803			0.2		
	σ_2	-0.2263	0.0084	-0.5116	0.0590	0.2		
(11)	γ_1						0.5	*
	γ_2						0.5	*
	γ_3						0.5	*
(12)	δ_1						0.5	*
	δ_2						0.5	*
	δ_3						0.5	*
(13)	Ω_1	0.6427	-0.1695	0.4380	0.8474	0.7		
	Ω_2	0.2549	0.4108	0.1067	0.4030		0.6	@
	Ω_3	0.6741	-1.0507	0.0297	1.3184	0.6		
	Ω_4	-0.0565	0.0100	-0.0913	-0.0216	0.1		
(14)	ε_1	0.2119	-0.1521	-0.1917	0.6156	0.2		
	ε_2	0.5784	-0.0031	0.1527	0.6904	0.6		
(15)	δ	0.3664	0.3414	-0.4372	1.1200	0.4		
(16)	ϕ_1						0.7	*
	ϕ_2						1.0	*

(17)	λ_1	0.5478	0.2744	-0.3525	1.1914	0.2		
	λ_2	0.2360	-0.5644	-0.1070	0.5790	0.2		
	λ_3	-0.9298	0.1675	-1.5280	-0.3276	0.2		

Note: (1) Estimated coefficients obtained from Chapter 6 by using FIML approach.

(2) Estimated coefficients obtained from Chapter 6 by using ECM.

* Harvie and Kearney (1996).

@ Author's calculation; LR long run; SR short run

6.1 *Simulation Results Arising from an Expansion in Public Capital Expenditure*

The purpose of this section is to analyse the effects of an expansion in capital expenditure on the Lebanese macroeconomy, for two cases:

Case 1. An instantaneous and unanticipated increase in public capital expenditure by 3%, which occurs immediately in the impact period (0').

Case 2. A gradual increase in public capital expenditure. The presumed increase in public capital expenditure is that of a 1% increase from its baseline on impact, then it is assumed to increase to 2% from its baseline in period 8 (the end of the short run period), and then an increase to 3% from baseline in period 12.

In both cases it is assumed that the budget deficit in Lebanon is financed partly through a temporary increase in the monetary growth rate by 2% (monetary growth is assumed to rise to 2% on impact, and then gradually declines and ends in period 12), and through an endogenous expansions of bonds.

The results of both cases are presented in Figure 3. All results for each variable are expressed as percentage deviations from their baseline values. The main finding from the simulation results, for the two cases assumed (unanticipated/gradual increase in public capital expenditure), is that this policy has some positive effects upon Lebanese economic development. The major benefits from such an approach are in regard to an increase in the q ratio, which has a positive impact on private sector investment, resulting in a large accumulation of private capital stock during the adjustment process. This also stimulates the supply side of the economy (crowding in effect). It is noticeable that the simulation results indicate that the private capital stock and aggregate supply increase in both cases during the adjustment process, but with larger volatility in case 1.

This policy has other advantages for the Lebanese economy, implying a gain of competitiveness and a better external performance on the trade and current accounts (due to a depreciation in the real exchange rate) and hence decreasing external borrowing. It is worth noting here as well that during the adjustment process the real exchange rate depreciates in both cases, but with less volatility in case 2. The disadvantage of this policy appears to be in the first year of the short run period. Here the rate of inflation in both cases is pushed up towards the baseline after an initial downturn due to the increase in aggregate demand being more than aggregate supply, in addition to the financing of the deficit through monetary growth.

The interest rate is higher as well during the first year of the short run period because of the increase in public spending arising from the funding component through bond sales; this increase in public spending stimulates aggregate demand for output and for money. But over the long run period, and where the monetary growth rate ends in financing the deficit in period 12 while maintaining the assumption that the deficit is financed through endogenous expansions on bonds, the rate of inflation falls back towards the baseline. The interest rate falls back as well towards the baseline, indicating little sensitivity to bond financing after period 12. Another important conclusion from this policy, in the context of the Lebanese economy, is that money deficit financing is inflationary, and shows large sensitivity in terms of interest rates. Bond financing a

deficit is non inflationary and shows little sensitivity in terms of interest rates. Furthermore, it can be concluded from the simulation results that this policy produces a positive impact upon almost all the key macroeconomic variables under consideration during the adjustment process towards the long run steady state. But it is noticeable that this policy produces the largest positive impact during the first year of the short run period in terms of domestic improvements as well as external improvements. Hence if the government gives priority to short-term policy outcomes this simulation result supports such a policy. The preferred approach by the government should be case 2 (gradual approach), because this produces considerably less volatility in terms of the major macro outcomes.

6.2. Simulation Results Arising from an Expansion in Government Consumption Expenditure

This subsection will examine the effects of an expansion in government consumption expenditure on key Lebanese macroeconomic variables, by assuming the following two cases:

1. An instantaneous and unanticipated increase in government consumption expenditure by 3%, which occurs immediately.
2. A gradual increase in government consumption expenditure. The presumed increase in government expenditure is 1% on impact, rising to 2% in period 8, and further increasing to 3% in period 12 (the first year of the medium run period).

In both cases it is assumed that the budget deficit in Lebanon is financed through a temporary increase in the monetary growth rate by 2% (the monetary growth is assumed here to increase 2% on impact, and then gradually falls and then ends in period 12), and through bond financing as well (bond financing is assumed to be endogenously determined).

The simulation results in both cases are reported in Figure 4. However, the simulation results arising from an expansion in government consumption expenditure for the two cases assumed, suggests that it could have some advantages and some disadvantages for Lebanese economic development. The advantage of this policy appears to be during the first year of the short run period in terms of domestic improvement, where both the private capital stock and aggregate supply increase. But by the end of the short run period the private capital stock and aggregate supply decline from their initial increase in both cases (to below the baseline in case 2, but above the baseline in case 1). The disadvantage of this policy appears to be during the adjustment process, where the trade balance deteriorates in both cases because of the appreciation in the real exchange rate. This deterioration in the trade balance implies a loss of competitiveness and deterioration in the external performance, trade and current account balance, hence exacerbating foreign debt. However, as can be seen from these simulation results, this policy appears to have some positive effects in terms of domestic improvements during the adjustment process towards long run steady state. But in terms of external developments this policy produces adverse effects during the adjustment process towards long run steady state. It is noticeable, as well, that this policy produces a large positive impact during the first year of the short run period in terms of domestic developments. The rate of inflation falls on impact but subsequently rises as aggregate demand increases faster than aggregate supply. Hence, if the government considers a short-term policy in order to improve only domestic developments such as private investment and aggregate supply, this simulation suggests support for such an approach. However, the government should pay particular attention to the adverse effects of this

policy in terms of external developments, especially foreign asset stocks which deteriorate in line with exacerbating foreign debt. Another important conclusion from this simulation scenario is that the government should adopt case 2 (gradual approach) because it produces less volatility in terms of the major macro outcomes.

However, a comparison between the simulation results for the first policy option (expansion in capital expenditure) and the second policy option (expansion in government consumption expenditure) indicates a number of suggestions for policy implementation, as follows:

a. Implementing the policy of an expansion in capital expenditure produces a larger favourable impact in terms of private sector investment, and in terms of the supply side of the economy (crowding in effect) during the whole adjustment process towards long run steady state. The policy of expansion in government consumption expenditure does not produce such a positive effect during the whole adjustment process, because this policy produces an unfavourable effect in terms of private investment and aggregate supply (crowding out effect) during periods 7 to 11.

Overall, the policy of an expansion in capital expenditure compares favourably to the other policy during the whole adjustment process. In terms of external developments it resulted in a gain of competitiveness and a better performance externally, trade and current account (due to a depreciation in the real exchange rate) as well as an accumulation in foreign asset stocks, hence decreasing external borrowing. The policy of an expansion in government consumption expenditure produced an unfavourable effect in terms of external developments during the adjustment process, the trade balance deteriorated in line with a deterioration in foreign asset stocks as a result of current account deficits implying an increase in foreign debt.

b. Implementing the two policies (expansion in capital expenditure/government consumption expenditure) produces a similar outcome in terms of the interest rate and the rate of inflation. However, both policies produce higher inflation during the short run period due to the increase in aggregate demand being more than aggregate supply, in addition to the financing of the deficit through monetary growth. The interest rate is higher as well during the first year of the short run period (lower on impact) due to the increase in public spending arising from the funding component through bond sales; this increase in public spending stimulates aggregate demand for output and money. However, the simulation results for the two policies indicate that money deficit financing is inflationary and shows large sensitivity in terms of interest rates. Bond financing is non inflationary and shows little sensitivity in terms of interest rates.

It can be concluded from the above discussion that if the government considers an expansionary fiscal policy in order to improve macroeconomic performance, the simulation results suggest that it should adopt an expansionary capital expenditure policy because it produces the most desirable outcomes. In addition, it should adopt a gradual approach because this produces considerably less volatility in terms of major macro outcomes.

6.3. Simulation Results Arising from the Lebanese Government's Approach to Dealing with the Financial Crisis

This scenario focuses upon the Lebanese government's policy approach in response to the development of the financial crisis in Lebanon. The policies, or government plan, to deal with this crisis, as assumed here and based as closely as possible upon these, are as follows.

First, tightening fiscal policy by reducing public capital expenditure as well as government consumption expenditure, by assuming a 3%⁹ decline. This reduction could occur by assuming two cases: case 1 - an instantaneous and unanticipated decline in capital expenditure as well as government consumption expenditure which occurs immediately in the impact period; case 2 - a gradual decline in these expenditures (1% decline from its baseline on impact, then a further decline by 2% from baseline in period 8, and then a 3% decline from baseline in period 12).

Second, an expansionary monetary policy by assuming an instantaneous and unanticipated increase in the monetary growth rate by 3% (case 1), as well as gradual increase in the monetary growth rate (case 2). The presumed increase in the monetary growth in case 2 is that of a 1% increase from its baseline on impact, then it is assumed to increase to 2% from baseline in period 8, and to further increase to 3% from baseline in period 12.

Third, increasing government revenues through increased taxes by assuming an increase in the parameter value for the tax revenue equation (equation 8 in the macroeconomic model from $\tau = 0.5$ to $\tau = 0.8$).

The results of this policy, for these two assumed cases, are reported in Figure 5. As shown in this Figure, implementing the government policy approach for both cases (unanticipated/gradual) results in adverse effects on almost all the key macroeconomic variables under consideration during the whole adjustment process towards long run steady state. This policy produces the largest negative impact during the short run period in terms of private capital stock, aggregate supply and foreign asset stocks. However, over the whole adjustment process, towards long run steady state, this policy has adverse effects in regard to a decline in private sector investment and in the supply side of the economy (crowding out effect). It is noticeable from the simulation results that the private capital stock and aggregate supply decline in both cases during the adjustment process, but with less volatility in case 2. Another cost of this policy is that the trade balance deteriorates in both cases during the adjustment process because of the appreciation in the real exchange rate. This deterioration in both cases also results in a deterioration in foreign asset stocks and current account balances, thereby adding to foreign debt. The decline in the trade balance in case 1 is slightly larger than that in case 2, due to a larger real exchange rate appreciation in case 2. The rate of inflation in both cases is pushed up despite the decline in aggregate supply, and this is due to the permanent increase in the monetary growth rate. The minor advantage of this policy appears to be over the impact period because aggregate supply improves in both cases with a larger magnitude in case 1 (unanticipated), despite an unchanged private capital stock.

However, it is clear from the simulation results that, in order to minimise the adverse effects of this policy, the government should adopt a gradual approach because it leads to much less macroeconomic volatility. Another important conclusion from such a policy is that if the government in Lebanon considers applying this approach over a short term period, the simulation results indicate that it will have the largest negative impact over the short run period in terms of private investment, aggregate supply, and foreign asset stocks. Another important finding that the government should be aware of is that this policy has the largest problem in terms of higher inflation, and this in turn exacerbates Lebanon's economic difficulties.

⁹ This study has chosen 3% for the simulation because it is in the middle of the feasible range of 1% to 5%.

Comparing the simulation results for the three government policies implemented separately (Figures 6-8) indicates that the policy of an expansionary monetary policy is favourable in terms of reducing the budget deficit compared to the other two separate policies. The expansionary monetary policy produces a favourable impact in terms of private sector investment, and in terms of the supply side of the economy during the adjustment process. However, this policy has an undesirable impact on inflation.

The other two separate policies produced unfavourable effects in terms of private investment and aggregate supply during the adjustment process. But it is noticeable from the simulation results (Figure 7-8) that the separate policy of a reduction in government capital expenditure produces the most undesirable outcomes compared to a reduction in government consumption expenditure.

Hence, the main finding from the three separate government policies is that the reduction in government expenditures (capital or consumption) exerts the most important and undesirable influence on the overall impact. The separate expansionary monetary policy produces a favourable impact compared to the others. Hence it is advisable, based upon the simulation results presented in this study, that if the government in Lebanon decides to implement this overall policy approach, it should be aware that the reduction in government expenditures, in order to reduce the budget deficit, is not the best strategy and especially the policy of reduction in government capital expenditure. If the government in Lebanon decides to implement the policy of expansionary monetary policy in order to reduce the budget deficit, our results show that this policy will have some positive effect on Lebanon's economy, but the government has to be aware that this policy has an inflationary effect.

7. Summary and Conclusions

The main focus of this paper has been to macro model prospective developments in the Lebanese economy for policy analysis and evaluation. The macroeconomic model developed was utilised to analyse the effects of exogenous shocks arising from increased government expenditures (capital expenditure or consumption expenditure) upon key macroeconomic variables. The current government's policy approach as well as the separate government policies in response to the Lebanese fiscal crisis was also analysed through the use of this macroeconomic model. The objective being to identify policies that reduce the macroeconomic consequences of these shocks and hence improve the macroeconomic performance in Lebanon.

Because of the complexity of the model, analysis of the steady state and dynamic properties of the model was conducted through the use of a numerical simulation procedure. Simulations require the specification of values for the numerous parameters in the model. These values are not available for Lebanon, therefore they were obtained from the estimation procedure conducted in this paper (FIML approach and ECM) and from those imposed because of data limitations or in order to ensure stability of the model.

However, it is clear from the simulation results that implementing the policy of expansion in government capital expenditure, for the two cases assumed, produces larger favourable impacts upon Lebanese economic development in terms of private sector investment, and in terms of the supply side of the economy (crowding in effects) during the whole adjustment process towards long run steady state. This policy produces, as well, favourable impacts in terms of external developments. It results in a gain of competitiveness and a better external performance, in terms of the trade and current accounts as well as accumulation in foreign asset stocks, hence decreasing

external borrowing. It is noticeable that this policy produces the largest positive impact during the first year of the short run period in terms of domestic improvements as well as external improvements. Hence, if the government gives priority to short-term policy outcomes this simulation result supports such a policy. Another important finding is that the government should adopt case 2 (gradual approach), because this produces considerably less volatility in terms of the major macro outcomes.

Implementing the policy of an expansion in government consumption expenditure produces unfavourable effects in terms of external developments during the adjustment process. The trade balance deteriorates in line with a deterioration in foreign asset stocks as a result of current account deficits, and hence results in an increase in foreign debt. This policy produces, as well, unfavourable effects in terms of private investment and aggregate supply (crowding out effect) during periods 7 to 11.

Implementing the two policies (expansion in capital expenditure/government consumption expenditure) produces similar outcome in terms of the interest rate and the rate of inflation. However, both policies produce higher inflation during the short run period due to the increase in aggregate demand being more than aggregate supply, in addition to the financing of the deficit through monetary growth. The interest rate is higher as well during the first year of the short run period (lower on impact period) due to the increase in public spending arising from the funding component through bond sales; this increase in public spending stimulates aggregate demand for output and money. However, the simulation results for the two policies show that money deficit financing is inflationary and shows large sensitivity in terms of interest rates. Bond financing is non inflationary and shows little sensitivity in terms of interest rates.

The main finding is that if the government considers an expansionary fiscal policy in order to improve macroeconomic performance, the simulation results suggest that the government should adopt the policy of an expansion in capital expenditure because it produces the most desirable outcomes. In addition, it should adopt a gradual approach because this produces considerably less volatility in terms of major macro outcomes.

The main findings from our simulation results dealing with the government approach to the fiscal crisis, does not support the government's current policy in dealing with the crisis. The results presented here suggest that it produces the most undesirable economic outcomes, and hence will only exacerbate Lebanon's economic difficulties. However, if the Lebanese government is willing to go ahead with this approach, it is advised that, based upon the results presented here, in order to minimise the adverse effects of this policy the government should adopt a gradual approach because it leads to much less macroeconomic volatility. Another important conclusion from such a policy is that if the government in Lebanon considers applying this approach over a short term period, the simulation results suggest that this will have the largest negative impact over the short run period in terms of private investment, aggregate supply, and foreign asset stocks. Another important outcome that the authorities should be aware of is that this policy has the largest problem in terms of higher inflation, and this in turn exacerbates Lebanon's economic difficulties.

The main finding from the three separate government policies is that the reduction in government expenditure (capital or consumption) exerts the most undesirable influence on the overall impact, and the separate policy of expansionary monetary policy produces a favourable impact compared to the others. Hence it is advisable, based upon the simulation results presented in this study, that if the government in Lebanon decides to implement this government approach, it should be aware that the reduction in government expenditures in order to reduce the budget deficit is not the best strategy and especially the policy of reducing government capital expenditure. If

the government in Lebanon decides to implement the policy of expansionary monetary policy, in order to reduce the budget deficit, our results show that this policy would have some positive effects on Lebanon's economy, but the government has to be aware that this policy has inflationary effects.

It is important to point out that this study is aware that there are other aspects (policy options) such as privatisation, borrowing from abroad (with lower interest rates compared to domestic rates), and income tax which are important in the context of the Lebanese fiscal crisis. But because of the already complex nature of the model, these scenarios are left for further research.

Table 3 ADF Test for Stationarity (Include an intercept but not a trend)

Variable ⁽¹⁾	I(0)		I(1)		I(2)		Result
	Test statistic ⁽²⁾	Critical value	Test statistic	Critical value	Test statistic	Critical value	
Real private consumption (C^p)	-3.5446[1]	-2.9750					I(0)
Real trade balance (T)	-2.2781[0]	-2.9750	-6.0524[0]	-2.9798			I(1)
Nominal exchange rate (e)	-1.0367[1]	-2.9750	-2.5152[0]	-2.9798	-6.0534[1]	-2.9850	I(2)
Domestic price level (p)	-9.2839[1]	-2.9750	-2.2834[0]	-2.9798	-5.8031[0]	-2.9850	I(2)
Real government investment (i^g)	-3.3565[0]	-2.9750					I(0)
Real private investment (i^p)	-3.1934[0]	-2.9750					I(0)
Real government consumption (C^g)	-1.8847[0]	-2.9750	-4.1476[0]	-2.9798			I(1)
Domestic nominal wage (w)	-7.5025[1]	-2.9750	-2.6221[0]	-2.9798	-6.6542[0]	-2.9850	I(2)
Rate of change of domestic nominal wage (\dot{w})	-2.6673[0]	-2.9750	-6.7969[0]	-2.9798			I(1)
Real private sector wealth (w^p)	-2.1781[1]	-2.9750	-3.2361[0]	-2.9798			I(1)
Domestic real wage ($w - p$)	-8.4581[0]	-2.9750	-5.8114[1]	-2.9798			I(1)
Inflationary expectations (π)	-2.3475[1]	-2.9750	-5.9255[0]	-2.9798			I(1)
Real public capital stock (k^g)	-1.4982[1]	-2.9750	-3.4225[0]	-2.9798			I(1)
Real private capital stock (k^p)	-2.1824[1]	-2.9750	-3.5304[0]	-2.9798			I(1)
Real net foreign assets (f)	-1.1863[1]	-2.9750	-2.2897[0]	-2.9798	-4.5573[2]	-2.9850	I(2)
Rate of change of real net foreign assets (\dot{f})	-2.3870[0]	-2.9750	-4.6173[2]	-2.9798			I(1)
Domestic nominal interest rate (r)	-1.6947[0]	-2.9750	-5.3432[0]	-2.9798			I(1)
Foreign interest rate (r^*)	-2.7564[1]	-2.9750	-4.0289[0]	-2.9798			I(1)
Real exchange rate ($e - p$)	-4.1195[2]	-2.9750	-3.4923[1]	-2.9798			I(1)
Foreign asset stock ($f + e - p$)	-1.4179[1]	-2.9750	-2.2738[0]	-2.9798	-4.8013[2]	-2.9850	I(2)
Real money supply ($m - p$)	-6.1534[0]	-2.9750	-4.2238[0]	-2.9798			I(1)
Demand for real output (y^d)	-2.9349[0]	-2.9750	-6.9244[0]	-2.9798			I(1)
World real income (y^*)	1.4516[0]	-2.9750	-4.6144[0]	-9.9798			I(1)
Foreign interest income ($r^* f$)	-2.7535[1]	-2.9750	-3.8448[0]	-2.9798			I(1)

⁽¹⁾ All variables in the Table are in logs except r , r^* , and T . ⁽²⁾ Figures in square brackets beside each test statistic represent optimum lags.

Table 4 ADF Test for Stationarity (Include an intercept and a linear trend)

Variable ⁽¹⁾	I(0)		I(1)		I(2)		Result
	Test statistic ⁽²⁾	Critical value	Test statistic	Critical value	Test statistic	Critical value	
Real private consumption (C^P)	-3.6077[0]	-3.5867					I(0)
Real trade balance (T)	-2.2507[0]	-3.5867	-6.0584[0]	-3.5943			I(1)
Nominal exchange rate (e)	-1.9087[1]	-3.5867	-2.4765[0]	-3.5943	-6.008[0]	-3.6027	I(2)
Domestic price level (P)	-1.9929[1]	-3.5867	-2.2247[0]	-3.5943	-5.7807[0]	-3.6027	I(2)
Real government investment (i^g)	-3.9123[0]	-3.5867					I(0)
Real private investment (i^P)	-3.1287[0]	-3.5867	-6.2892[0]	-3.5943			I(1)
Real government consumption (C^g)	-1.9968[0]	-3.5867	-4.1108[0]	-3.5943			I(1)
Domestic nominal wage (W)	-1.8486[1]	-3.5867	-2.5605[0]	-3.5943	-6.6057[0]	-3.6027	I(2)
Rate of change of domestic nominal wage (\dot{W})	-2.5955[0]	-3.5867	-6.7359[0]	-3.5943			I(1)
Real private sector wealth (w^P)	-2.0878[1]	-3.5867	-3.2185[0]	-3.5943	-5.8816[0]	-3.6027	I(2)
Domestic real wage ($w - p$)	-2.3165[0]	-3.5867	-5.6866[0]	-3.5943			I(1)
Inflationary expectations (π)	-2.2212[0]	-3.5867	-5.9112[0]	-3.5943			I(1)
Real public capital stock (k^g)	-1.5870[1]	-3.5867	-3.5821[0]	-3.5943	-6.5156[0]	-3.6027	I(2)
Real private capital stock (k^P)	-2.0677[1]	-3.5867	-3.5346[0]	-3.5943	-6.4894[0]	-3.6027	I(2)
Real net foreign assets (f)	-2.0612[1]	-3.5867	-2.2892[0]	-3.5943	-4.5844[2]	-3.6027	I(2)
Rate of change of real net foreign assets (\dot{f})	-2.3841[0]	-3.5867	-4.5664[2]	-3.5943			I(1)
Domestic nominal interest rate (r)	-1.4020[0]	-3.5867	-5.3932[0]	-3.5943			I(1)
Foreign interest rate (r^*)	-2.8623[1]	-3.5867	-3.8998[0]	-3.5943			I(1)
Real exchange rate ($e - p$)	-2.9099[1]	-3.5867	-3.4533[1]	-3.5943	-4.4478[1]	-3.6027	I(2)
Foreign asset stock ($f + e - p$)	-2.2040[1]	-3.5867	-2.2839[0]	-3.5943	-4.7899[2]	-3.6027	I(2)
Real money supply ($m - p$)	-1.5785[0]	-3.5867	-4.1306[0]	-3.5943			I(1)
Demand for real output (y^d)	-2.7658[0]	-3.5867	-5.8985[1]	-3.5943			I(1)
World real income (y^*)	-1.9412[0]	-3.5867	-4.6184[0]	-3.5943			I(1)
Foreign interest income ($r^* f$)	-3.5329[1]	-3.5867	-4.0728[3]	-3.5943			I(1)

Figure 3 Expansion in Public Capital Expenditure (Case 1 and Case 2)

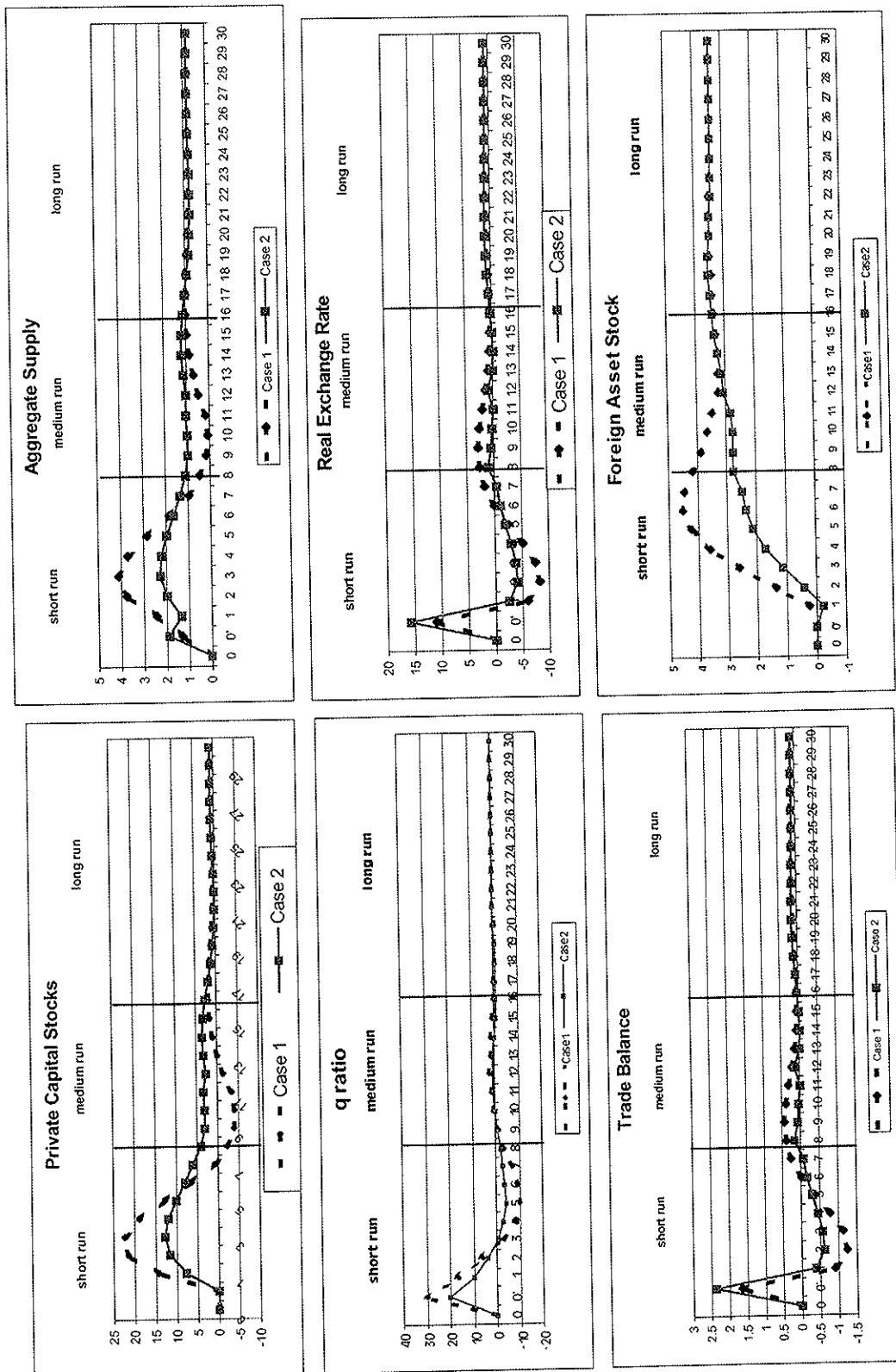


Figure 4 Expansion in Government Consumption Expenditure (Case 1 and Case 2)

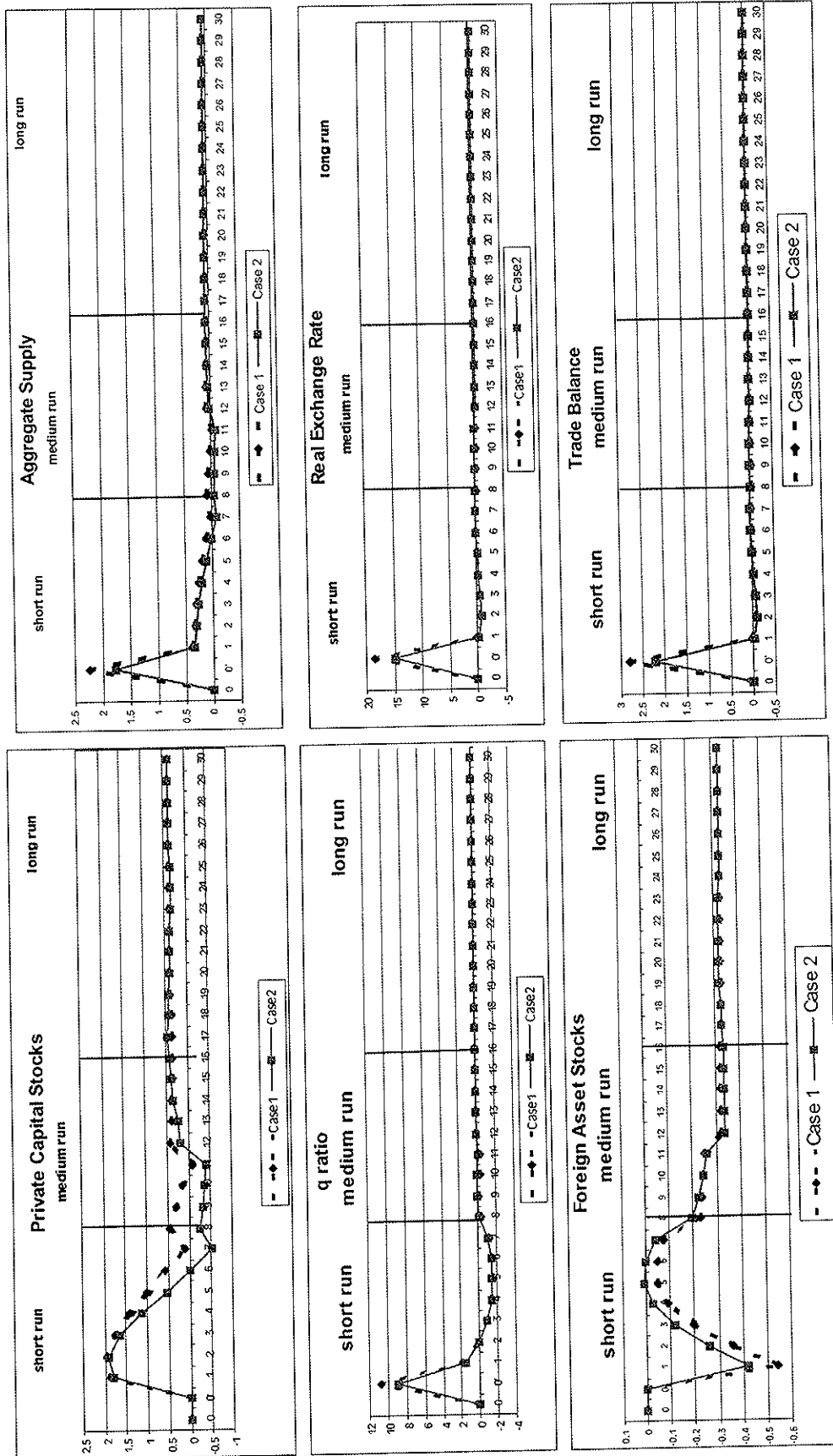


Figure 5 Government Policy Approach (Case 1 and Case 2)

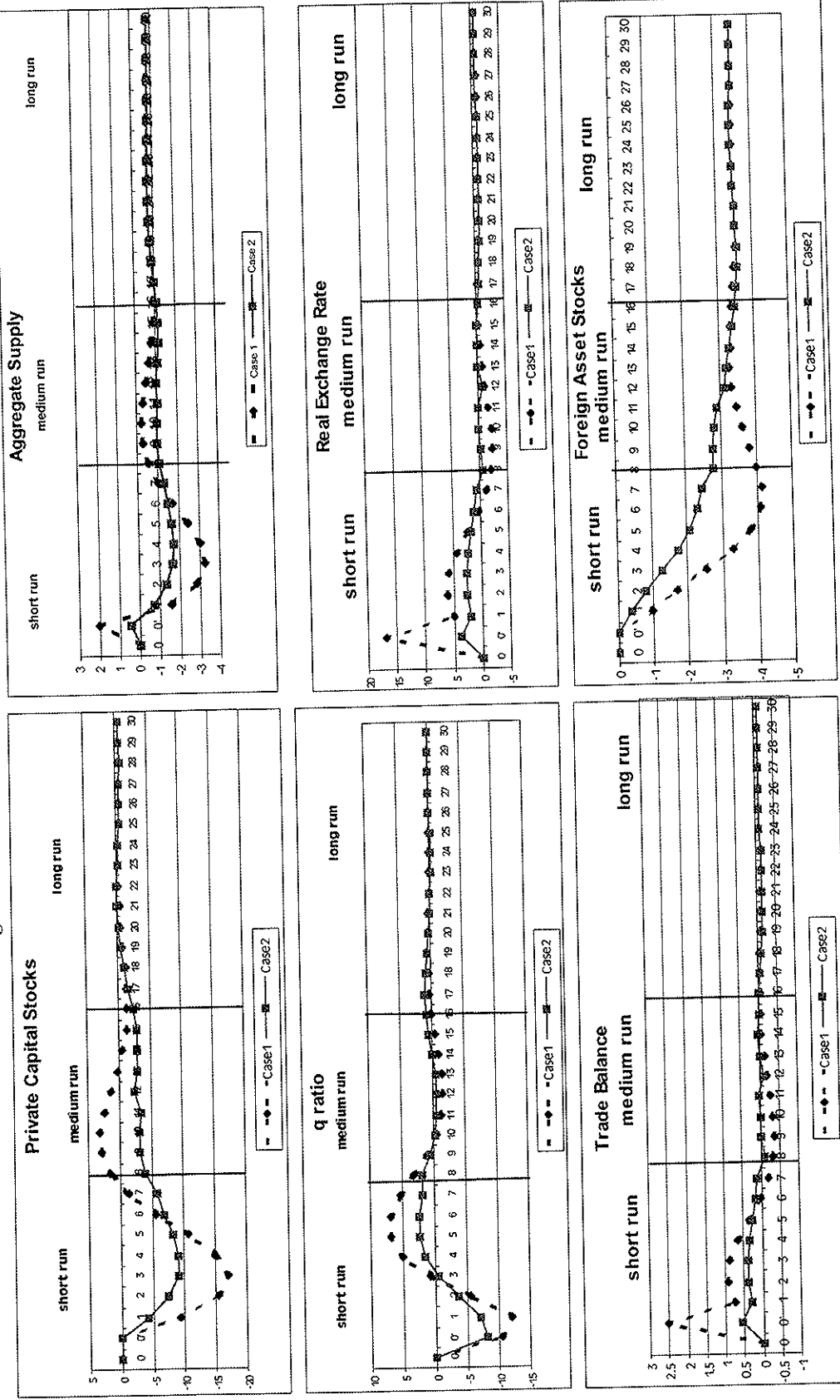


Figure 6 Increase in the money supply (Case 1 and Case 2)

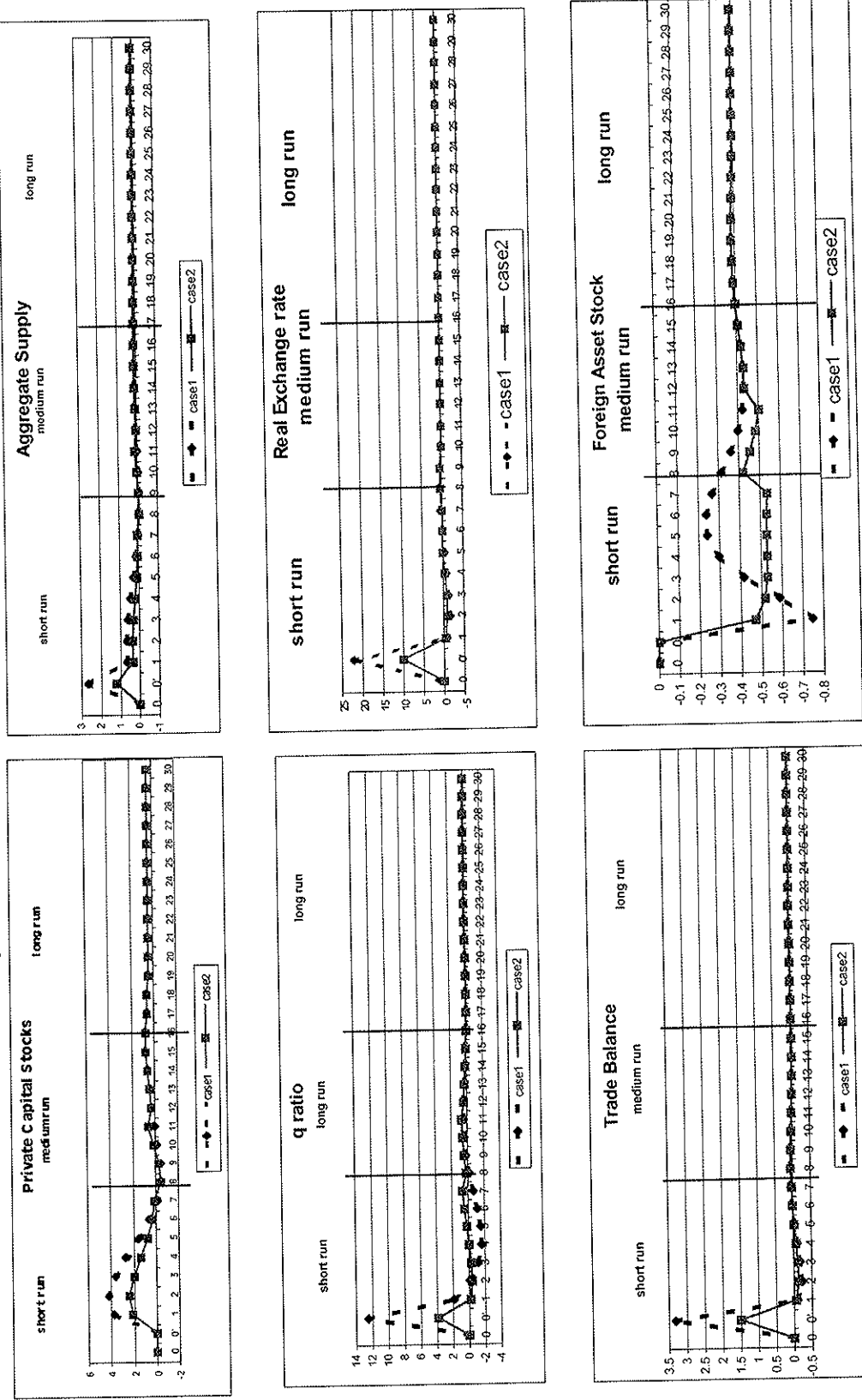


Figure 7 Decrease in government capital expenditure (case 1 and case 2)

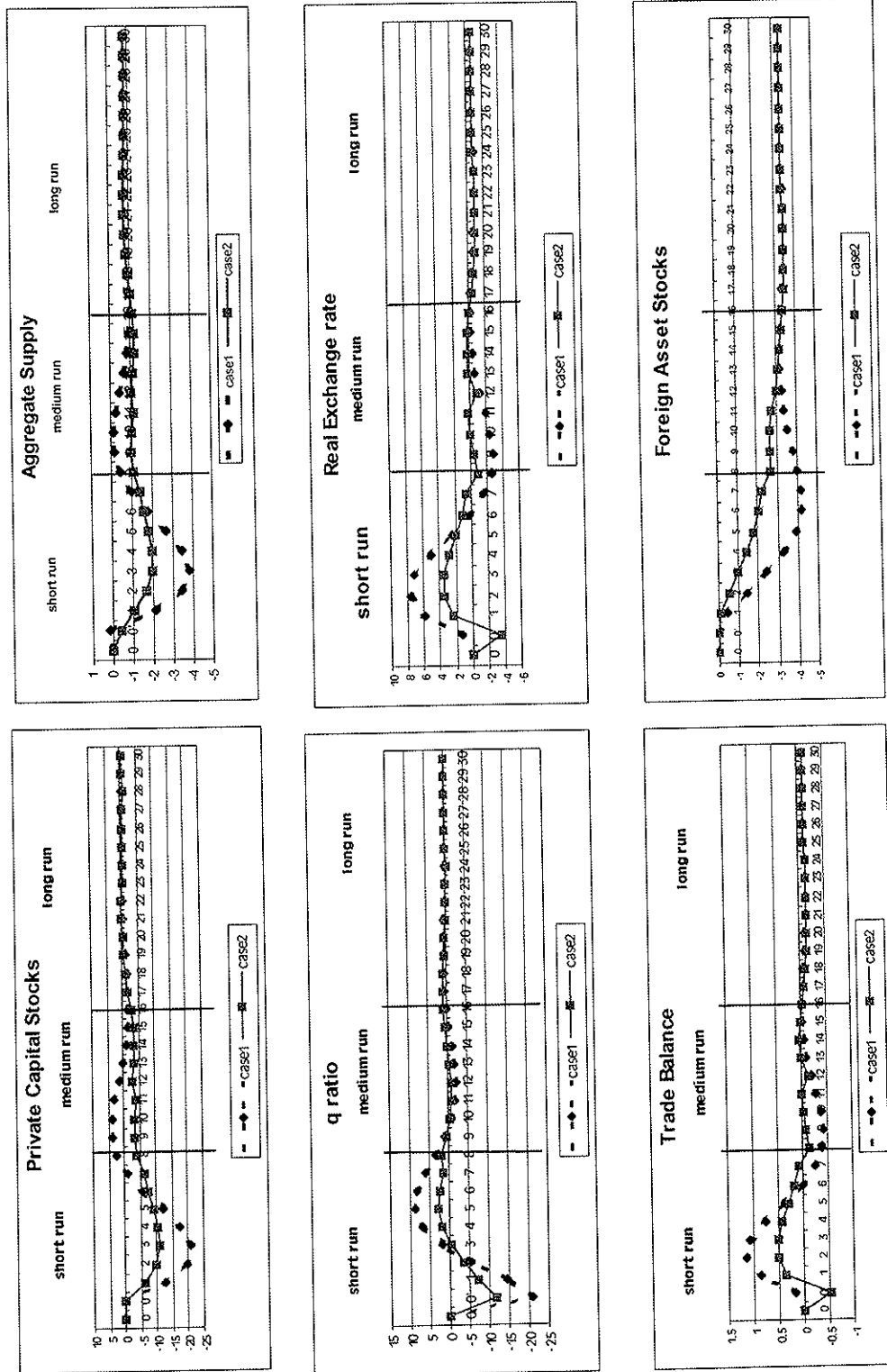
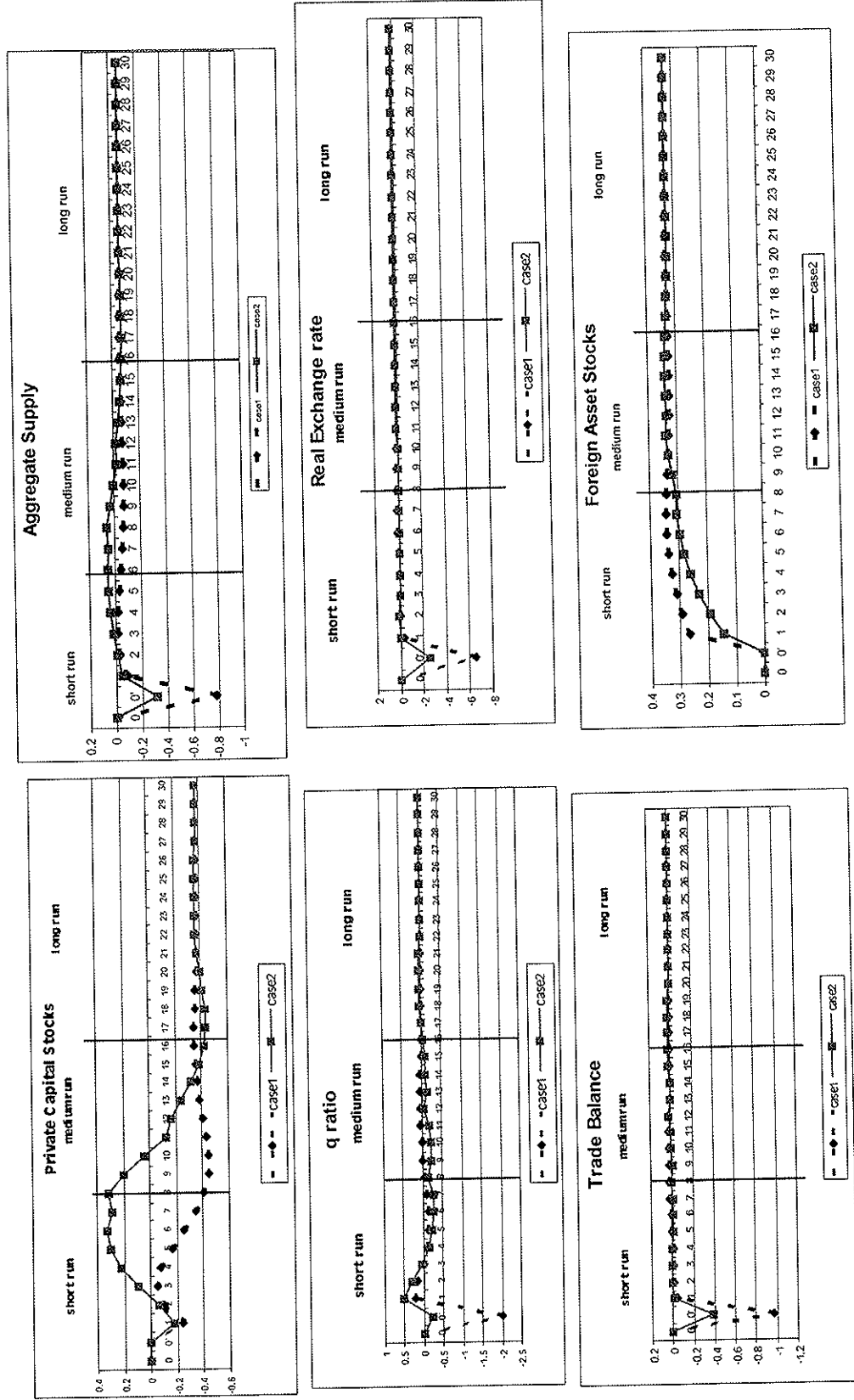


Figure 8 Decrease in government consumption expenditure (case 1 and case 2)



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